AI Planning
Exercise Sheet 11

Date: January 23, 2015
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Exercise 11.1

(a)

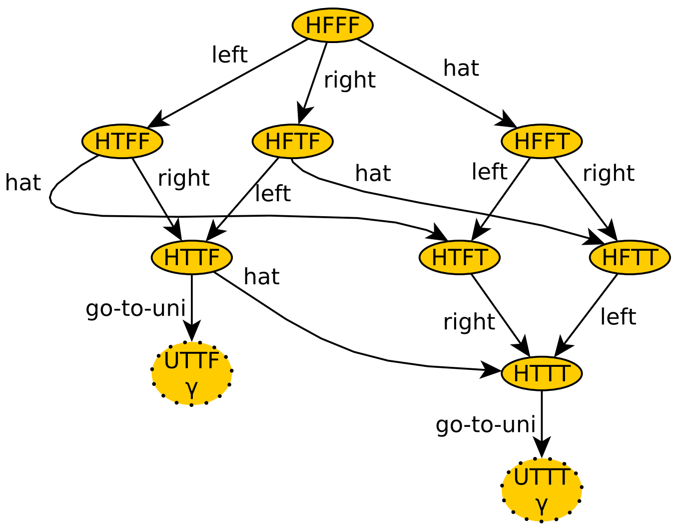

Figure 1: breadth-first search graph (with dublicate detection)

(b)

First Node Expansion

Possible initial disjunctive action landmarks are {wear-left-shoe}, {wear-right-shoe}, {go-to-university}. The last of those is not yet applicable. The tie break between the remaining two is decided in favor of $L = \{\text{wear-left-shoe}\}$.

Compute T_S:

1. Include wear-left-shoe in T_S as disjunctive action landmark
2. no other applicable operators interfere with wear-left-shoe
3. for go-to-university, which is not applicable yet T_S contains a necessary enabling set.

$T_S = \{\text{wear-left-shoe}\}$

Second Node Expansion

disjunctive action landmark: $L = \{\text{wear-right-shoe}\}$ Compute T_S:

1. Include wear-right-shoe in T_S as disjunctive action landmark
2. no other applicable operators interfere with wear-right-shoe
3. for go-to-university, which is not applicable yet T_S contains a necessary enabling set.

$T_S = \{\text{wear-right-shoe}\}$

Third Node Expansion

disjunctive action landmark: $L = \{\text{go-to-university}\}$ Compute T_S:

1. Include go-to-university in T_S as disjunctive action landmark
2. Include hat in T_S since it interferes with go-to-university (go-to-university disables hat)

$T_S = \{\text{go-to-university, hat}\}$

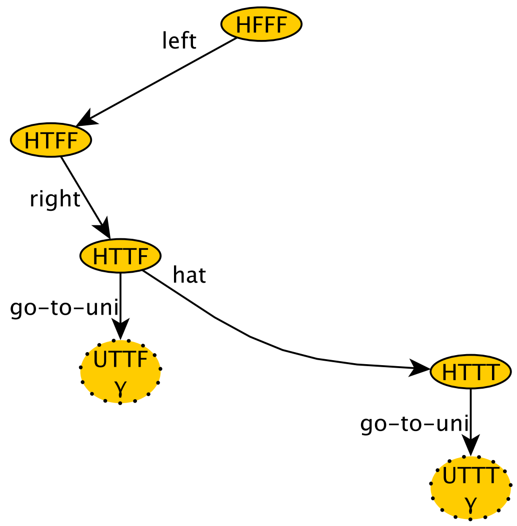

Figure 2: breadth-first search graph using strong stubborn set pruning

Conclusion

We save $14 - 5 = 9$ node expansions. The solution length in both cases is 3.

Exercise 11.2

Preliminaries

For every variable $v \in prevars(o)$ (Only for $o \in app(s)$?) we need to compute the Domain transition graph:

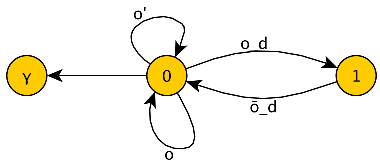

Figure 3: DTG(a)

All given operators are "Active Operators" (see lecture 13, slide 14), because of

- For every variable $v \in prevars(o)$ there is a path in $DTG(v)$ from $s(v)$ to $pre(o)(v)$.
- If v is goal-related, then there is also a path from $pre(o)(v)$ to the goal value $\gamma(v)$.

Disjunctive Action Landmark:

$L = \{o, o'\}$ in initial state

Strong Stubborn Sets

1. Include o (or o') in T_S as disjunctive action landmark.
2. Include o_d in T_S since it interferes with o (o_d disables o)
3. Include o' (or o) in T_S since it interferes with o_d (o_d disables o')
4. Include $\overline{o_d}$ and o_i in T_S since both conflict with o_d
5. Include $\overline{o_i}$ in T_S since it conflicts with o_i

$T_S = \{o, o', o_d, \overline{o_d}, o_i, \overline{o_i}\}$
All six operators included in T_S, no pruning.

Weak Stubborn Sets

1. Include o (or o') in T_S as disjunctive action landmark.
2. there are no operators in s that have conflicting effects with o or that are disabled by$o$

$T_S = \{o\}$
Nice amount of pruning.

Conclusion

Weak stubborn sets admit exponentially more pruning than strong stubborn sets.

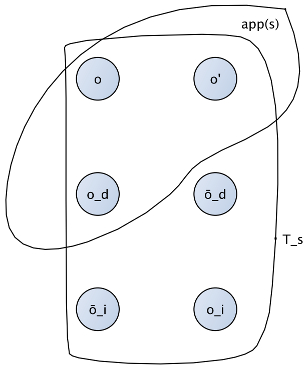

Figure 4: strongStubborn

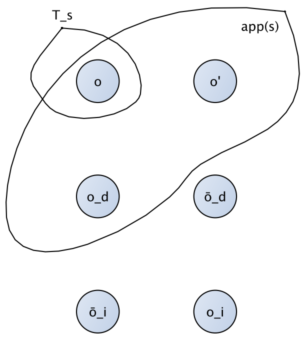

Figure 5: weakStubborn